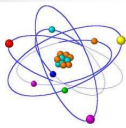


## Unit 1 – Physics, the Characteristics of Electricity!!!!

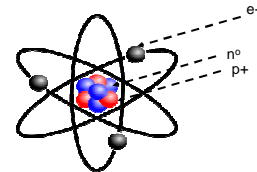
## 10.1 Exploring Static Charges



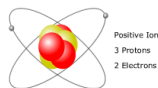
- All matter is made up of atoms.
- Atoms are **neutral** because they contain an **equal number of protons and electrons**.
- Different materials hold on to their electrons with different strengths.
- We can force the electrons to move from one object to another, this creates a “**charge**”



- **Electrons are the only charged particles that can be transferred!!!**
- Protons never move they are inside the nucleus!!



- If an **atom does not have an equal number of  $p^+$  and  $e^-$** , it is said to **have an electric charge** and is **called an ion**.
- An atom that has **gained  $e^-$**  is a **negative ion**.
- An atom that has **lost  $e^-$**  is a **positive ion**.



Balloons and sweatshirt

- <http://phet.colorado.edu/en/simulation/balloons>

John travoltage

- <http://phet.colorado.edu/en/simulation/travoltage>

When an electric charge is created on **only one area** of the surface of an object it is called **static electricity**. A static charge will not move! The charge remains in the same place that it was created.

■ Ex:



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In spite of the protests from animal rights groups, doctor Clemens continues his experiments on static electricity.

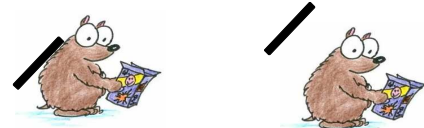
## Charging by Friction

- Rubbing two different **neutral** materials together to create a charge is a process known as **charging by friction**.
- The different materials hold onto their electrons with different strengths.



- As the materials rub together the electrons that are more weakly held are "lost" by that material and collect on the other material because it has a strong hold on electrons.

Ebonite Rod  
(type of rubber)



After the materials have been rubbed together they will have **opposite charges**.

## Electrostatic Series (p.405)

- List of materials that have been arranged according to their ability to hold on to electrons
- The material with atoms that have a stronger hold on electrons = **Negative charge**
- The other material with atoms that have a weaker hold on electrons = **Positive charge**

## Electrostatic Series

**Material**  
Human skin  
Rabbit fur  
Acetate  
**Glass**  
**Human hair**  
Nylon  
Wool  
Fur  
Silk  
Paper  
Cotton  
Wood  
Amber  
Rubber  
Vinyl  
Polyester  
Ebonite

Charge Tendency



Weak hold on e-



Increasing tendency to gain electrons



Strong hold on e-

## Homework

- Read p. 403 – 406
- Do ques. P. 410 #1-4

## Electrostatic Series

*Using the Electrostatic Series, explain what happens to the electrons and the charge on each item.*

1. What would happen if you rubbed **acetate** with **cat's fur**?
2. What would happen if you rubbed **ebonite** with **silk**?
3. What would happen if you rubbed **amber** with **cotton**?
4. What would happen if you rubbed **human skin** with **cotton**?

## Conductors



- Materials that **allow electrons to move easily** through them are called **conductors**; they conduct electricity.

Ex: silver, copper, aluminum...**METALS!**,  
electrolyte solutions (solution that contain ions,  
salt water)



- **Semi-conductors** also move electrons, a well-known example is silicon



## Insulators

- Materials that **do not allow electrons to move** through them easily are called **insulators**.

□ Ex: plastic, wool, pure water, rubber, most non-metals

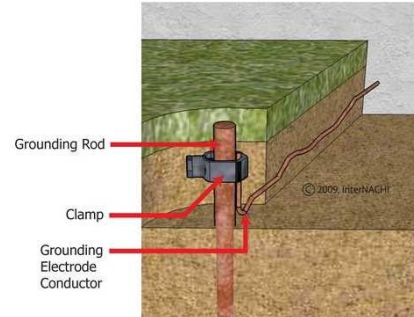



## Insulators and Conductors

- Materials that are insulators tend to build up static charges more easily, or more often because once the  $e^-$  have been transferred to that material they can not move around.
- Charges can be built up on conductors, however any charge built up on a surface that is a conductor will evenly spread out on that surface.

## Grounding

- Grounding is when an object is connected to the **ground** (or some other large body) by a metal wire. Grounding an object that is already charged will **return that object to neutral**. It is a way to **discharge** the object.
- The grounding wire allows e<sup>-</sup> to move either up or down the wire. This gets rid of excess charge by supplying a safe route for the e<sup>-</sup> to travel along.



- If a grounding wire is always attached to an object it prevents the build up of excess charge.
- The symbol for grounding is 

## Homework

- Read p. 406 – 410
- Do ques. #5-8